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Title:
Process for producing powdered wax

Abstract:
A process for producing powered material, e.g. powdered wax, comprises tangentially introducing a cooling gas into the upstream end of a chamber to provide a swirling gas movement from the upstream to the downstream end of the chamber, feeding molten material droplets into the chamber upstream and to impinge the swirling gas, maintaining the droplets in suspension until their solidification and withdrawing the gas and particulate material from the chamber.

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(71) Applicants
NL Industries Inc.,
New York, State of New York, United States of America
(72) Inventor
A. A. Bellinger
(74) Agents
Stevens, Hewlett & Perkins,
5 Quality Court, Chancery Lane, London WC2A 1HZ

(54) Process for producing powdered wax

(57) A process for producing powered material, e.g. powdered wax, comprises tangentially introducing a cooling gas into the upstream end of a chamber to provide a swirling gas movement from the upstream to the downstream end of the chamber, feeding molten material droplets into the chamber upstream and to impinge the swirling gas, maintaining the droplets in suspension until their solidification and withdrawing the gas and particulate material from the chamber.

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The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

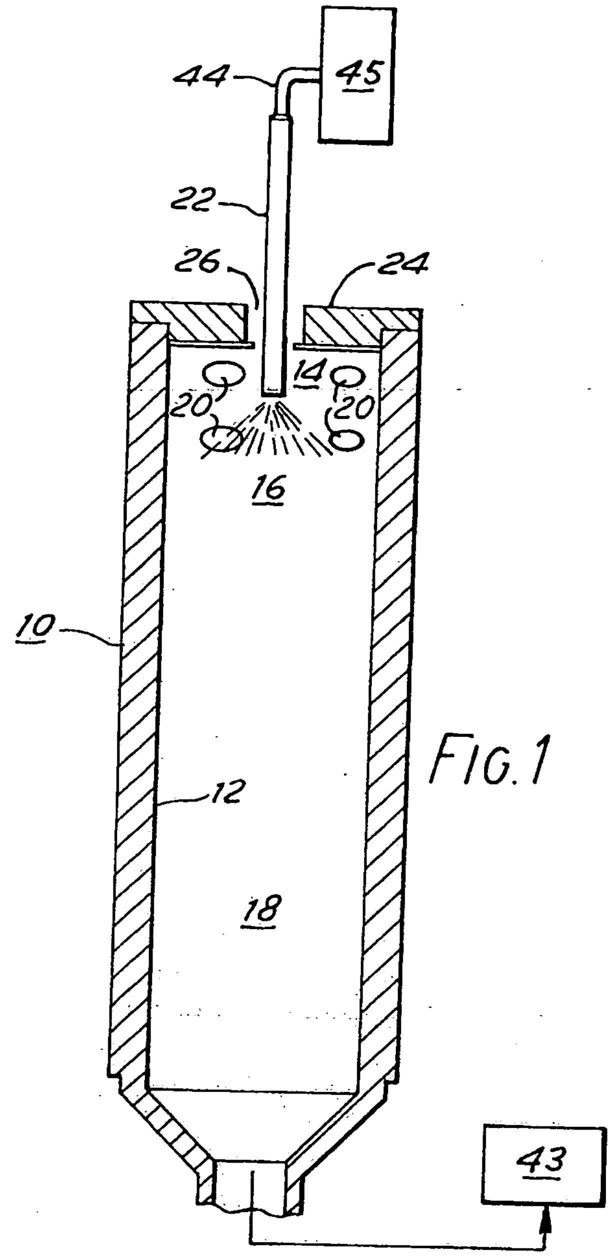
44
45
22
26
24
14
20
20
16
10
12
18
43

FIG. 1

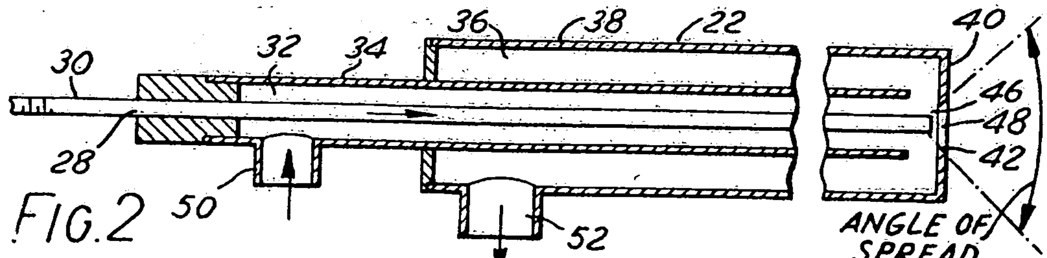
36
38
22
40
30
32
34
46
48
42
28
50
52
ANGLE OF SPREAD

FIG. 2

SPECIFICATION

Process for producing powdered wax

Background of the Invention

This invention relates to a process and apparatus for producing powdered material having reduced particulate diameters.

Typically, techniques for producing particulate materials from molten materials having relatively high melting points of about 100°C include the introduction into a cooling gas stream or on to a slinger disc to affect relative atomization and small droplet formation. The droplets then cool into generally spherical particles as they progress through the chamber.

Low rate spray nozzles are capable of producing relatively fine wax particles; but not of the size produced by the process of this invention. They also tended to buildup material and chamber walls which must be removed periodically with the resultant shutdown.

One process for particulate formation is illustrated in U.S. Patent No. 3,804,744 which discloses heating a paraffin wax to a temperature between 50°C and 70°C forcing the paraffin wax at this temperature through sprayers at a pressure that may vary between 7 and 21 kg/cm^2, entraining the paraffin wax from the sprayers in a high velocity flow of cold air to cool the product down to its solidification temperature, maintaining the powdered paraffin entrained in the air flow while increasing the velocity to 85 to 110 km/hr until the mixture of powdered paraffin wax and air is discharged into a separator for collecting the powdered paraffin wax. The chamber measured approximately 7 to 12 meters. In '744, the liquid paraffin wax was sprayed at a rate of 1 kg of powdered paraffin wax per 9 to 12 m^3/hr of cooling air. The velocity of the cold air flow at the injection point ranges from 20 to 35 meters/second. This process results in particle size distribution of a) over 0.080 mm, from 2% to 5%, b) between 0.080 and 0.045 mm, from 10% to 13%, c) between 0.045 and 0.018 mm, from 25% to 30% and d) under 0.018 mm up to 100%.

Another method is illustrated by Landis, U.S. Patent No. 4,190,622 issued February 26, 1980 entitled "Process for Prilling Urea". This patent disclosed a method for production of urea prills in which molten urea droplets are contacted with a concurrent gas stream which partially solidifies the urea to form a prill which is cooled and collected in a second zone comprising a fluidized bed in which a second gas stream flowing countercurrent to the first air stream completed the solidification of the particles.

Prior art also includes Dundas, U.S. Patent No. 4,246,208 issued on January 20, 1980 entitled "Dust-Free Plasma Spheroidization". This patent disclosed a process for manufacturing dust-free spheroids of magnatite beads which included introducing the raw magnatite ore particles in the presence of an inert non-oxidizing carrier cast to a carbon arc plasma flame assembly. As a part of the method, a flow the countercurrent flow of air is provided to remove dust lines, the flow of air ringing the circumference of the spheroidization chamber. The dust-free formed particles are removed by means of a cyclone and bag filters.

Prior art devices and systems while useful for many purposes have not been found capable of production of powdered material having reduced particle sizes on a continuous basis.

Summary of the Invention

A process is disclosed for producing wax particulates from a molten material having particle sizes not greater than a predetermined reduced size, including the steps of introducing tangentially at least one stream of cooling gases into the upstream end of an elongated chamber, thereby providing a swirling gas movement from the upstream end of the chamber to the downstream end of the chamber, injecting droplets of the molten material into the upstream end of the chambers from not more than one source to impinge the swirling cooling gases, maintaining the injected droplets in suspension in the swirling cooling gases until the droplets have solidified to form particulates having particle sizes not greater than the predetermined reduced size, withdrawing the suspension of cooling gases and particulate from the chamber and recovering the particulates from the cooling gases.

Brief Description of the Drawings

Figure 1 is a fragmentary longitudinal sectional view of a particulate forming chamber of a circular cross-section which may be used in carrying out of the aspect this invention in which the molten paraffin wax is injected axially into the swirling stream of cooling gases.

Figure 2 is a longitudinal section of the molten wax injector assembly.

Detailed Description of the Invention

An improved process and system of this invention is generally illustrated in Figure 1 of the drawings. There is represented the upstream end of the elongated chamber 10 of a circular cross-section which opens at its downstream end into a conventional separating apparatus. The circular cross-section inner wall 12 of chamber 10 is constructed of suitable material adapted to eliminate adhesion of the droplets of molten material to the wall as well as minimizing corrosion and cleaning problems thereof. One suitable material for use with wax, for instance is stainless steel.

Within the upstream end of the chamber there is provided a gas entering zone 14 coaxially connected with a mixing zone 16, coaxially connected with the remainder of the chamber 10, the cooling zone 18. It will be understood, however, that the chamber 10 may be of uniform cross-section throughout, i.e. the mixing zone 16 being a direct continuation of the entering zone 14. The diameter of the remainder of chamber 10 may be somewhat reduced downstream from the mixing zone 16. For generation of the swirling

cooling gases, gases for cooling are drawn tangentially into chamber 10 through gas conduits 20 delineated by a wall 12 of chamber 10.

A single source of molten wax is used for injection of the wax, one such source being illustrated in Figure 2, where an injector assembly 22 extends coaxially through the upstream end wall 24 of chamber 10 into the mixing zone 16 and where it passes through the wall 24 is surrounded by sleeve 26 through which the assembly 22 is free to slide so as to adjust position of injector assembly 22 with respect to the upstream wall 24 of the mixing zone. The injector assembly comprises a coaxially positioned cylindrical make conduit 28 delineated by tube 30 and surrounded for a greater portion of its length by coaxial annular passageway 32 lying between the tube 30 and the tubular wall 34. The tubular wall 34 is, in turn surrounded by a coaxial annular passageway 36 delineated by outer cylindrical wall 38. Secured to the downstream end of tube 30, tubular wall 34 and outer cylindrical wall 38, as by welding, is a circular plate 40, secured in a manner so as to provide fluid communication between passageways 32 and 36 and to be fluid tight with respect to tube 30. The circular plate 40 is provided with a coaxially positioned exit port 42 in fluid communication with conduit 28.

To increase the production of the particulates the number of the chambers should be increased on the throughput of the nozzle and cooling gas in each chamber.

In operation, the cooling air is drawn tangentially and axially into the entering zone 14, moving through the mixing zone 16, and the cooling zone 18, and out of chamber 10 into the separation zones 43. The separation zone may consist of a cyclone separator, bag filters or other conventions separation means or combination thereof. The air is drawn through the apparatus by a vacuum means which maintains the apparatus at a negative pressure such that little or no particles escape. This precaution is necessary since the small wax particles present an explosion risk. The wax make is charged to the injector assembly 22 from any suitable source 45 through inlet 44 to the conduit 28 and passes through conduit 28 inwardly to exit port 42 where the exit port 42, at its outer end, may be flared outwardly to form a conical seat 46 adapted to cooperate with the coaxially positioned conical member 48 to form an outwardly flaring, adjustable annular opening for injecting the wax make in a conical pattern with a predetermined angle of spread.

Because of the nature of the molten wax used, it is desirable to be protected from cooling while passing through the injection assembly 22, in order to avoid solidification. For these reasons, the assembly is jacketed as previously described for circulation of a heating medium, such as steam. The heating medium is introduced through inlet 50 passing through the inner annular passageway to the outer end of the assembly 22 back through annular passageway 36 and out through outlet 52.

The molten material may be selected from a large number of materials which may be melted and recrystallized. Preferably the material is wax. More preferably the wax is derived from castor oil. The preferably castor oil derived waxes are hydrogenated, substituted with hydroxyl groups or mixture thereof. The more preferable castor oil derived wax is a mixture of hydrogenated castor oil wax and 12-hydroxy-stearic amide. Preferably the mixture comprises about 75 wt% hydrogenated castor oil wax and about 25 wt% 12-hydroxy-stearic amide.

For any particular type of make injector, the desired spread angle may be readily determined by a simple test. Optimum spray angles in a particular type of operation may depend upon other operating conditions including the location of the make injector with respect to the mixing zone, the relative amounts of wax make and cooling air and the diameter of the chamber.

The ratio of cubic feet of cooling gas to pounds of wax should preferably range from about 50:1 to 500:1. More preferably, the range should be from about 150:1 to 400:1. Most preferably, the ratio of gas to wax should be 300:1.

The temperature of the entering molten material should be above the melting point of the material. The temperature of the cooling gas should be below the solidification temperature of the material. Preferably the temperature of the gas-solidified wax mixture should be at least about 10°C below the solidification temperature of the material.

In a preferred process where the molten material is wax, the preferred temperature of the entering molten wax is at least about 70°C and the preferred temperature of the entering cooling gas is less than about 38°C and that of gas solidified wax mixture is about 50°C.

The method of this invention is most useful for production of particulates of paraffin waxes. In particular, waxes may be produced having reduced particle sizes less than about 45 microns.

Other materials, however, may be processed in a similar manner to produce particulates of reduced particle diameters. The materials useful for injection in this invention should have a melting point between about 65°C and 150°C.

The wax make may be injected under pressure of the order of 70 to 120 psig. The make should be sprayed in such a manner as to create droplets size which can be solidified into particles having the desired diameters. Preferably, the make is atomized at moderate pressures by conventional means to create a suitable spray atomization. The coaxial injection system may be enhanced by the use of hot air or steam as a propelling and atomizing material.

The chamber 10 need not be airtight and, particularly, the aspiration of ambient air about the make injection is preferred.

CLAIMS

1. A process for producing particulates from molten material having particle sizes not greater

than a predetermined reduced size, comprising introducing tangentially at least one stream of cooling gases into the upstream end of an elongated chamber, thereby providing a swirling gas movement from the upstream end of said chamber to the downstream end of said chamber, injecting droplets of said molten material into the upstream end of said chambers from not more than one source to impinge said swirling cooling gases, maintaining said injected droplets in suspension in said swirling cooling gases until said droplets have solidified to form particulates having particle sizes not greater than said predetermined reduced size, withdrawing said suspension of cooling gases and particulates from said chamber and recovering said particulate from said cooling gases.

2. The process of Claim 1 wherein said molten material is wax.

3. The process of Claim 2 wherein said molten wax is at a temperature of at least about 70°C.

4. The process of Claim 3 wherein the temperature of said cooling gas is not greater than about 45°C.

5. The process of Claim 1 wherein said molten wax droplets have diameters not greater than said predetermined reduced size.

6. The process of Claim 1 wherein said molten wax is atomized prior to injection into said chamber.

7. The process of Claim 1 wherein said molten wax is axially injected into said chamber.

8. The process of Claim 1 wherein in ratio of cubic feet of cold gas to weight of molten wax ranges from about 50:1 to about 500:1.

9. The process of Claim 1 wherein the molten wax stream is injected downstream from the introduction of the cold gas stream.

10. The process of Claim 5 wherein the chamber has a circular cross section.

11. The process of Claim 1 wherein the longitudinal axis of the chamber is vertical.

12. The process of Claim 1 wherein the molten wax stream is injected at a pressure so as to avoid impingement of the wax on the wall of said chamber.

13. The process of Claim 1 wherein the molten wax is injected into the chamber as an expanding conical spray stream.

14. The process of Claim 9 wherein said upstream end of said chamber is above said downstream end of said chamber.

15. The process of Claim 1 wherein said molten material is wax.

16. The process of Claim 15 wherein said wax is derived from castor oil.

17. The process of Claim 16 wherein said wax is selected from a group consisting of a hydrogenated castor oil wax, and substituted castor oil wax and mixture thereof.

18. The process of Claim 17 wherein said wax comprises hydrogenated castor oil wax and 12-hydroxystearic amide.

19. The process of Claim 18 wherein said wax comprises 75 wt% hydrogenated castor oil wax and 25 wt% 12-hydroxystearic amide.

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